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Highlights

- High recovery of cellulose (>80%) under optimum conditions
- Up to 80% removal of lignin achieved using 50% GVL
- 94% theoretical ethanol yield achieved with PSSF
- Production of 181 kg ethanol per dry ton of Eucalyptus sawdust

ABSTRACT: Optimisation of conditions for gamma- valerolactone (GVL) pretreatment of Australian eucalyptus sawdust for high cellulose biomass and bioethanol production was demonstrated. Pretreatment parameters investigated included GVL concentrations of 35-50% w/w, temperatures of 120-180°C and reaction durations of 0.5-2.0 h. Optimum conditions were determined using the response surface method (RSM) and central composite face-centred design. Cellulose content increased from 39.9% to a maximum of 89.3% w/w using treatments with 50% GVL at 156°C for 0.5 h. Temperature had the most significant effect (RSM $p<0.05$) on cellulose content of residual biomass and reducing operational duration of <0.5 h may be viable according to RSM. PSSF fermentations of optimised pretreated eucalyptus sawdust produced up to 94% theoretical ethanol yield, which corresponded to approximately 181 kg of ethanol per dry ton of eucalyptus sawdust. The compositions of both the residual biomass and pretreatment liquors show that GVL pretreatment is a promising solvent for lignocellulosic biorefining.

KEYWORDS: Organosolv pretreatment, Eucalyptus, gamma-Valerolactone, PSSF, Lignocellulose.

1. INTRODUCTION

Abbreviations used in Manuscript
-valerolactone – GVL
Residual Biomass- RB
Pre-hydrolysis simultaneous saccharification and fermentation- PSSF
Nonylpheol- NP
Response Surface Methodology- RSM
Non-Significant- NS
Cellulose recovery %- CR